Continuous Density Measurements and Volumetric Properties of Mixtures of Propane and n-Octane at High Pressures

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A versatile experimental system has been used to create density-pressure scans by continuously recording the volume, and thus the density of fluids and fluid mixtures under pressure. The system involves a variable-volume view-cell, a motorized pressure generator, a sensor that continuously monitors the position of a piston moving in the variable-volume part of the view cell when pressure is altered, and a data acquisition system. A computer interface and dedicated software allows the real time recording of the pressure, temperature, piston position, and transmitted light intensity. At a given temperature, pressure scans are generated in either the increasing or decreasing direction of pressure at selected rates adjustable by the speed settings of the motorized pressure generator. With an initial calibration of the internal volume of the cell and the mass loading of the fluid or fluid mixture in the cell, *Pressure vs Volume* or *Pressure vs Density* plots are easily generated. Depending upon the pressure scan rate and the sampling rate employed, 5 to 9,000 data points are generated which leads to essentially continuous pressure-density curves. The scans show clearly any phase change that is accompanied by a change in the global density of the mixture with identification of exact pressure/temperature conditions where such phase changes occur. The density data are readily correlated and are used to generate important thermodynamic quantities such as the isothermal compressibility, isobaric expansivity, pressure coefficient, and excess volume. In this paper we will report the volumetric properties of propane, n-octane and their binary mixtures over wide range of temperatures from 320 to 440K at pressures up to 40 MPa. Density vs Pressure data for the pure fluids and the mixtures will be modeled with a cubic three parameter RK-PR equation of state that offers the best performance among cubic three-parameter density functionalities as well as the Statistical Associating Fluid Theory (SAFT).